SUMMARY
Measurement of the strength and direction of magnetic fields in coronal plasmas is arguably the most important observable required for advances in our understanding of the emergence of magnetic flux into the solar atmosphere and the processes responsible for the periodic activity, coronal heating and coronal dynamics. The CORonal Solar Magnetism Observatory (COSMO) is a proposed ground-based suite of instruments designed to routinely study coronal magnetic fields and their environment. The facility will provide unique data and ignite key advances. The CORONAL Research Association (HCOR) in collaboration with the University of Hawaii and the University of Michigan. It will replace the current NACR Mauna Loa Solar Magnetometer. The adaptive coronal magnetometer is designed to collect synoptic coronal data for over 40 years in support of the solar and heliophysics community (http://rsos.hawaii.edu). COSMO will provide the data necessary to drive the development of magnetic field models for our nearest neighbor. The magnetic field plays a significant role in the dynamics of the heliosphere. COSMO will also provide high resolution white light images of CMEs in the very low corona (down to 1.05 solar radii).

ADVANCES IN INTERPRETATION TOOLS
To prepare for the exploitation of these new observations, we have started developing tools and techniques for comparing forward models of coronal magnetic fields with observations from COMP and Solar-C, as well as for interpreting observations. Figure 3 shows a three-dimensional visualization of an axisymmetric current sheet in the Sun's corona as it would be observed by the Fe XII emission line at 1074.6 nm. The current sheet is derived from the synthetic model of Fe XII line emission from the SUNRISE Workshop. The top and bottom panels are for a current sheet with sufficient magnetic flux to launch a CME while the bottom two panels show the result of applying minus (negative) sign to the horizontal magnetic field. This is the same current sheet with an identical value of the radial component of the magnetic field in the solar corona; however, the polarization signatures are extremely different for the two cases. This example illustrates the sensitivity of measurements of the polarization of coronal emission lines to the degree of magnetic field rotation. These differences in linear and circular polarization signals will be measurable by COSMO over scientifically interesting spatial and temporal scales.

BREACKTHROUGH SCIENCE

What are the relationships between photospheric and coronal magnetic fields? How does photospheric forcing impact coronal and solar wind dynamics? Forcing of the corona by photospheric flux emergence and motions can be addressed with COSMO by examining large-scale, long-lived coronal structures associated with surface field activity, differential rotation. These can provide a key to understanding the magnetic field evolution of the corona.

What kind of magnetic field configurations lead to the launch and acceleration of coronal mass ejections? Simple inspection of the morphology of the magnetic fields in force-free vs. potential fields (see Figure below) shows that the polarization signatures will be very different and accessible by COSMO. It will also provide the highest resolution white light images of CMEs in the very low corona (down to 1.05 solar radii).

What is the nature of the changes in coronal magnetic structure that accompany the 11-year solar cycle? The CMEs induced reconfiguration of magnetic fields? COSMO will provide daily observations (from 17:17 UT to 02:30 UT) of the coronal magnetic field down to 1 Gauss over a 360-degree field-of-view and will be operated 365 days per year, weather permitting. PROPOSED INSTRUMENTS

A white-light polarized-brightness (pB) coronagraph, effectively to replace the Mauna Loa Mk IV system by a modern, large-aperture coronagraph of far superior sensitivity and temporal resolution needed to provide observations of CME formation and early acceleration. This coronagraph will provide two key capabilities: (1) detection of the third white-light CME that is currently inaccessible in the corona; and (2) images that will provide the coronagraph to detect CMEs at the Earth-Sun line.

A chromospheric imager devoted to recording a significant fraction of geo-effective CME events on the solar disk via the disruption of the prominences seen on the disk (filaments) in lines of H and He-I. This instrument would be able to detect and image the prominence using high resolution line-of-sight Doppler shifts.

PROPOSED SCIENCE OBJECTIVES AND INSTRUMENT REQUIREMENTS

TECHNOLOGY DEMONSTRATION

COSMO AND THE COMMUNITY

Due to its scientific relevance and its expected far-reaching impact, COSMO will pursue a new paradigm of community involvement and innovation. The targeted community is focused on, but not limited to, US universities pursuing solar and heliophysics research. The university community will be an intrinsic part of the entire COSMO effort, and will be represented by the COSMO team. The community will be involved in all phases of the COSMO project - from the early development of the project concept to the eventual operation of the facility. The COSMO team will be involved in all phases of the COSMO project - from the early development of the project concept to the eventual operation of the facility. The COSMO team will be involved in all phases of the COSMO project - from the early development of the project concept to the eventual operation of the facility.